***Remarks:***

*Claims*

*Claim Rejections - 35 U.S.C. §102(e) - Hirota'927*

**A.** Claims 1-2 stand rejected under 35 U.S.C. §102(e) for allegedly being anticipated by Hirota et al. (Hirota'927) (United States Patent No. 6,233,927 B1). In particular the Examiner asserts:

> Regarding claims 1-2, Hirota discloses a diesel engine exhaust system comprising a soot filter (e.g., 7, 19); and low temperature NO2 trap (11) deposited on a carrier upstream and in train with the soot filter (e.g. See Fig. 5; col. 7, lines 23-67; col. 8, lines 1-15); wherein the exhaust system further comprises a diesel oxidation catalyst (18) upstream of the carrier with the deposited NO2 trap material (e.g. See Fig. 4).

Applicant respectfully disagrees. While Hirota'927 discloses an exhaust system comprising a soot filter and $NO_x$ adsorbent material upstream and in train with the soot filter, what it does not disclose is low temperature $NO_2$ trap material. In fact, the NOx adsorbent material disclosed in Hirota'927 is said to absorb and discharge NOx on the basis of the air-fuel ratio of the exhaust gas flowing into the adsorbent (see col. 4, lines 1-6). The systems disclosed in the reference achieve a decrease in the air-fuel ratio (i.e., achieve a rich condition) by an increase in the amount of fuel injected into the engine (see col. 4, lines 56-67). The NOx is said to be reduced by the fuel (i.e., hydrocarbon and/or carbon oxide) in the system disclosed in the reference. A more specific description of the composition of the NOx adsorbent in the system of Hirota'927 is absent.

Applicant's claimed invention is directed to a system that utilizes low temperature $NO_2$ trap material which refers to material that adsorbs $NO_2$ at lower temperatures, and releases the $NO_2$ under lean conditions into the exhaust stream at higher temperatures to regenerate the $NO_2$ trap material (see page 6, lines 30-32 of the instant specification). This property provides Applicant's system with significant advantages in treating diesel engine exhaust over systems such as those described in Hirota '927.

In particular, one advantage of using low temperature $NO_2$ trap material in the system is that a significant fuel savings can be achieved. Conventional $NO_2$ trap materials including those disclosed in Hirota 927 typically rely on lowering the air/fuel ratio in the exhaust to trigger the release of stored $NO_2$. However, air-fuel ratios of diesel engine exhaust are almost always on the

lean side (see page 7, lines 4-10 of the instant specification), and typically require some additional provision to lower the air/fuel ratio, i.e., injection of fuel. A system that relies on lowering the air/fuel ratio therefore incurs a fuel penalty which undermines one of the major impetuses for using a diesel engine, which is their excellent fuel economy. In contrast, the diesel engine exhaust system of the invention does not rely on lowering of the air/fuel ratio to achieve NOx reduction; instead it relies on the temperature in the exhaust stream.

Another advantage achieved by employing low temperature $NO_2$ trap material is that the $NO_2$ released by the trap material in response to higher temperatures is available to combust the soot fraction which is trapped downstream on the soot filter. In contrast, in the system disclosed in Hirota '927, fuel (carbon oxide and hydrocarbon) is used to reduce the NOx (col. 4, lines 63-67), and therefore less NOx (and more specifically, $NO_2$) is available to combust the soot fraction trapped downstream in the system.

Accordingly, reconsideration and withdrawal of the rejection under §102(e) are respectfully submitted.

*Claim Rejections - 35 U.S.C. §103(a) - Hirota'927 and Hirota'246*

Claims 3-5 and 10-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hirota'927 in view of Hirota et al. (Hirota'246) (U.S. Patent No. 6,367,246 B1). In particular the Examiner contends:

> Regarding claims 3, 17-18, and 21, Hirota'927 discloses a diesel engine exhaust system comprising: a soot filter (e.g. 7, 19); and low temperature NO2 trap (11) deposited on a carrier upstream and in train with the soot filter (See col. 3, lines 32-67; col. 4, lines 1-14). However Hirota'927 fails to disclose that the low temperature NO2 trap material comprising zeolites selected from the group consisting of acidic zeolites and base metal-exchanged zeolites.
>
> Hirota'246 teaches that it is conventional in the art, to use a low temperature NO2 trap material comprising zeolites selected from the group consisting of acidic zeolites and base metal-exchanged zeolites (e.g. See col. 3, lines 32-67; col. 4, lines 1-14), which are carried on a carrier for absorbing the NOx when the air-fuel ratio of the exhaust gas flowing into the absorbent is lean, and releasing the NOx when the air-fuel ratio of the exhaust gas flowing into the absorbent is rich.
>
> It would have been obvious to one having ordinary skill in the art at the time the invention was made, to use a low temperature NO2 trap material comprising

zeolites selected from the group consisting of acidic zeolites and base metal-exchanged zeolites of Hirota'927, as taught by Hirota'246 for the purpose of absorbing the NOx when the air-fuel ratio of the exhaust gas flowing into the absorbent is lean, and releasing the NOx when the air-fuel ratio of the exhaust gas flowing into the absorbent is rich, so as to reduce the poisoned materials in the purifying catalyst and to reduce amount of nitrogen oxides in the exhaust gas of the lean-burn engine, and further improve the performance of the engine and the efficiency of the emission device.

Regarding claim 4, Hirota'246 further discloses that the zeolites are selected from the group consisting of ZSM-5, ETS-I0, y zeolite, Beta zeolite, ferrierite, mordenite, titanium silicates, and aluminum phosphates (See col. 11, lines 5-47).

Regarding claim 5, Hirota'246 further discloses that the base metals are selected from the group consisting of Mn, Cu, Fe, Co, W, Re, Sn, Ag, Zn, Mg, Li, Na, K, Cs, Nd, Pr and combinations thereof (See col. 11, lines 5-47).

Regarding claim 10, Hirota'927 further discloses that the a diesel oxidation catalyst (18) upstream of the soot filter (7) (See Fig. 4).

Regarding claim 11, Hirota'926 further discloses that the NO2 trap material (11) is deposited on a carrier that is interposed and in train with the diesel oxidation catalyst (18) and the soot filter (7) (see Fig. 4).

Regarding claim 12, Hirota'246 further discloses that the system comprising a canister, wherein the canister houses both the low temperature NO2 trap material and the soot filter (See Fig. 4; col. 6, lines 10-56).

Regarding claim 13, Hirota'246 further discloses that the soot filter comprises a ceramic monolithic structure having an upstream axial end and a downstream axial end, the structure having parallel flow channels with macroporous walls, wherein the channels having an opening at the upstream axial end are closed at the downstream axial end, and the channels having an opening at the downstream axial end are closed at the upstream axial end, thereby defining upstream and downstream sides of the channel walls (See col. 3, lines 32-67; col. 4, lines 1-14).

Regarding claim 14, Hirota'246 further discloses a catalyst composition is deposited on the downstream side of the channel walls of the soot filter (See col. 3, lines 32-67; col. 4, lines 1-14).

Regarding claim 15, Hirota'246 further discloses that the catalyst composition, deposited on the downstream side of the channel walls of the soot filter, comprises a lean NOx catalyst composition (See col. 3, lines 32-67; col. 4, lines 1-14).

Regarding claim 16, Hirota'246 further discloses that the catalyst composition, deposited on the downstream side of the channel walls of the soot filter,

> comprises a catalyst composition effective for the combustion of unburned hydrocarbons and carbon monoxide (See col. 3, lines 32-67; col. 4, lines 1-14).
>
> Regarding claim 19, Hirota'245 further discloses that the low temperature NO2 trap material comprises zeolites selected from the group consisting of acidic zeolites and base-metal exchanged zeolites (See col. 3, lines 32-67; col. 4, lines 1-14).
>
> Regarding claim 20, Hirota'246 further discloses that the exhaust system further comprises a lean NOx catalyst deposited on the soot filter (See col. 3, lines 32-67; col. 4, lines 1-14).

Applicant respectfully disagrees. In particular, Applicant does not agree that Hirota'246 teaches low temperature $NO_2$ trap material comprising zeolites selected from the group consisting of acidic zeolites and base-metal exchanged zeolites. Applicant notes that the portion of Hirota'246 where the Examiner cites a description of $NO_2$ trap material in the reference, i.e., col. 3, lines 32-67; col. 4, lines 1-14, does not, in fact, disclose the low temperature $NO_2$ trap material described in instant claim 3. Hirota'246 describes the $NO_2$ trap material as follows at col. 3, lines 61-66:

> The NOx storing member **62** is formed of a NOx adsorbent ***62a***. This NOx adsorbent ***62a*** is comprised of at least one selected from a precious metal including palladium Pd, platinum Pt, and rhodium Rh, a transition metal including copper Cu and iron Fe, and lithium Li, carried on a carrier of alumina, for example...

Applicant submits that Hirota'246 does disclose zeolite materials: however, these materials are disclosed in the context of their use as hydrocarbon adsorbent (see col. 4, lines 14-19).

Accordingly, absent the disclosure of low temperature $NO_2$ trap material comprising zeolites selected from the group consisting of acidic zeolites and base-metal exchanged zeolites as recited in instant claim 3, Hirota'246 fails to underpin the obviousness rejection. Reconsideration is therefore respectfully requested.

*Claim Rejections - 35 U.S.C. §103(a) - Hirota'927, Hirota'246 and Deeba*

Claims 6-9 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hirota'927 in view of Hirota'246 as applied to claims 3, 17-18 and 21, and further in view of Deeba et al. (Deeba) (U.S. Patent No. 6,093,378). Specifically, the Examiner posits:

> Regarding claim 6, Hirota'927 in view of Hirota'246 discloses all the claimed limitation as discussed above except that the zeolites comprise a trivalent metal which in combination with Si forms an oxidic skeleton.
>
> Deeba discloses a diesel engine exhaust system comprising: a low temperature NO2 trap material comprising zeolites selected from the group consisting of acidic zeolites and base metal-exchanged zeolites, and wherein the low temperature NO2 trap material is deposited on a carrier, wherein the zeolites comprise a trivalent metal which in combination with Si forms an oxidic skeleton (See col. 10, line 5-67; col. 11, lines 1-45).
>
> It would have been obvious to one having ordinary skill in the art at the time the invention was made, to use a low temperature NO2 trap material comprising zeolites selected from the group consisting of acidic zeolites and base metal-exchanged zeolites of Hirota'927 in view of Hirota'246, as taught by Deeba for the purpose of absorbing the NOx when the air-fuel ratio of the exhaust gas flowing into the absorbent is lean, and releasing the NOx when the air-fuel ratio of the exhaust gas flowing into the absorbent is rich, so as to reduce the poisoned materials in the purifying catalyst and to reduce amount of nitrogen oxides in the exhaust gas of the lean-burn engine, and further improve the performance of the engine and the efficiency of the emission device.
>
> Regarding claim 7, Deeba further discloses that the trivalent metal comprises at least one metal selected from the group consisting of Al, B, Ga, In, Fe, Cr, V, As and Sb (See col. 10, lines 5-67; col. 11, lines 1-45).
>
> Regarding claim 8, Deeba further discloses that the zeolites comprise three-dimensional alumina-silicate zeolites characterized by pore openings whose smallest cross-section dimensions are at least 5 Angstroms and having a silicon to alumina ratio of at least 5 (See col. 10, lines 5-67; col. 11, lines 1-45).
>
> Regarding claim 9, Deeba further discloses that the zeolites comprise titanium silicates (See col. 12, lines 10-67; col. 13, lines 1-32)

Applicant respectfully disagrees with the rejection regarding claims 6-9. As noted above, Hirota'246 fails to disclose low temperature $NO_2$ trap material comprising zeolites selected from the group consisting of acidic zeolites and base-metal exchanged zeolites. Hirota '246 therefore fails to underpin the obviousness rejection with regard to claims 3-5 and 10-21. Therefore the rejection of claims 6-9 further in view of Deeba cannot stand.

Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**FEE DEFICIENCY**

☒ If an extension of time is deemed required for consideration of this paper, please consider this paper to comprise a petition for such an extension of time; The Commissioner is hereby authorized to charge the fee for any such extension to Deposit Account No. 04-0480.

**and/or**

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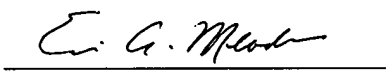
*Closing Remarks*

Applicants thank the Examiner for the Office Action and believe this response to be a full and complete response to such Office Action. Accordingly, favorable reconsideration in view of this response and allowance of the pending claims are earnestly solicited.

Respectfully submitted,



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